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(54) Web Formation

(57) Forming a coherent web of fibrous strands by feeding an array of strands, e.g. woollen yarns, 10 side by side into the nip of a pair of rollers 16, 18 one of which 16 has a series of parallel V shaped grooves 20 and applying adhesive to the array, e.g. from a trough 22 and supporting the web 24 so-formed until the adhesive cures or is cured. Compression of the strands in the V shaped grooves 20 prevents or reduces strike-through of the adhesive to the upper face of the web. A second pair of nip rollers 26, 28 may be provided with the roller 26 having grooves aligned with roller 16 to provide a first curing zone 25. If desired a backing sheet 32 from a roll 34 may be fed into the second nip where it will laminate to the web 24. A second curing zone 31 completes the curing and the finished web is wound on to a take-up roller. The web produced is a decorative fabric which may be used for a variety of products, such as lampshades and wall coverings.

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

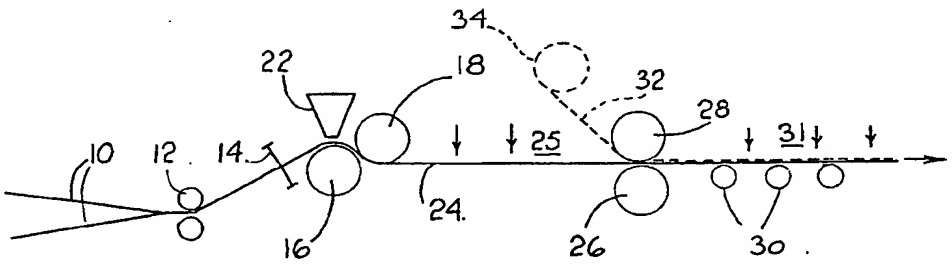

fig. 1.

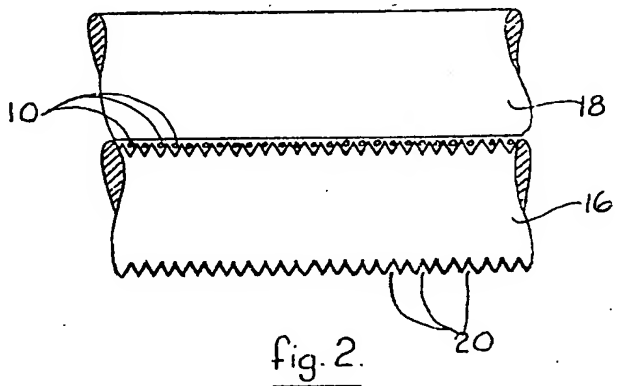

fig. 2.

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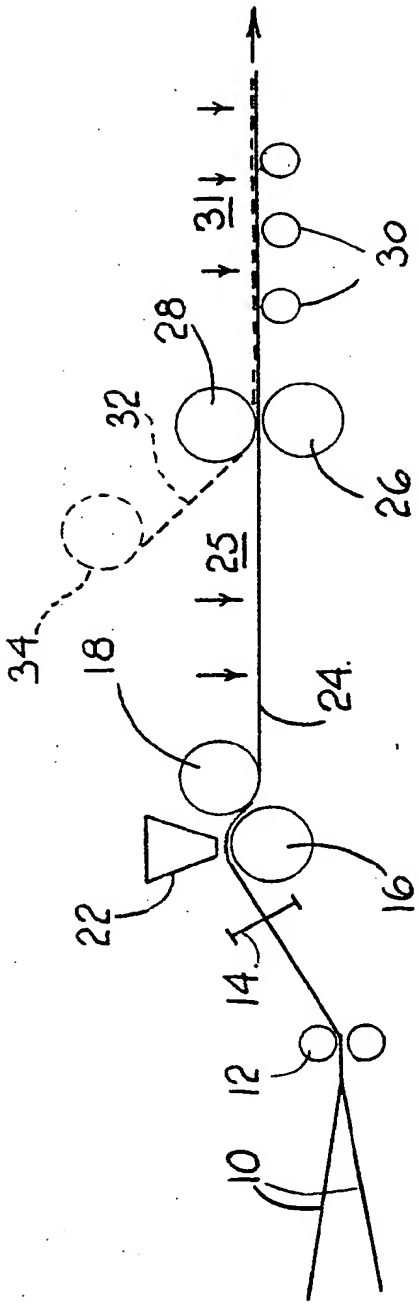

fig. 1.

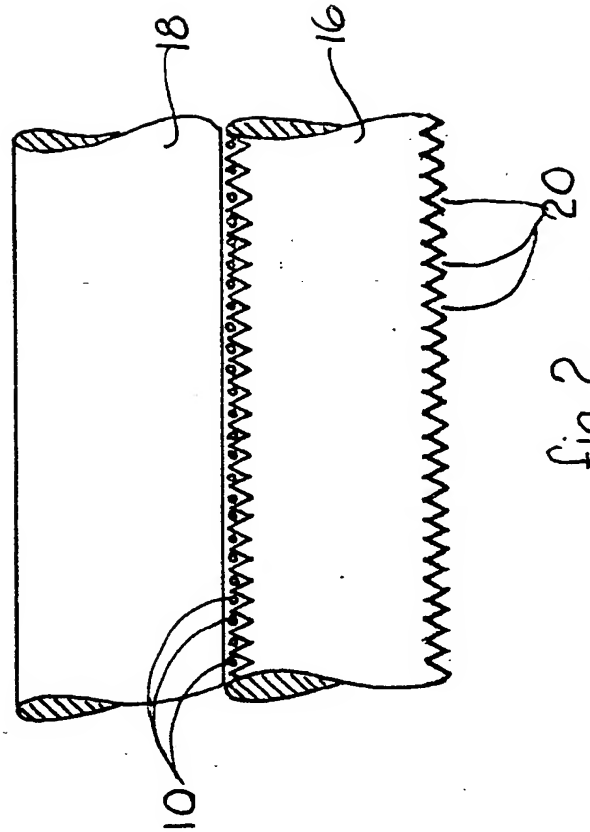

fig. 2.

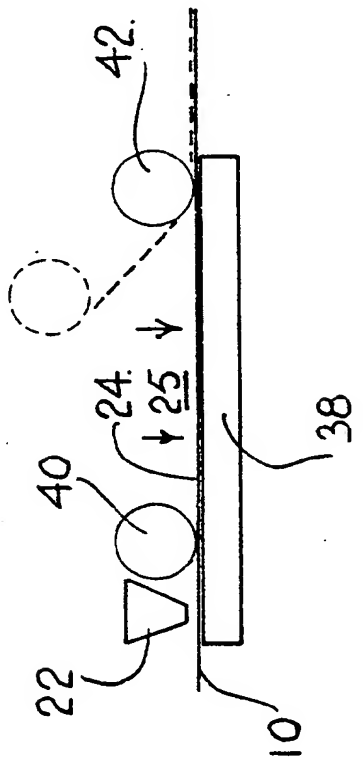

fig. 3.

SPECIFICATION
Web Formation

This invention relates to the formation of a coherent web of fibrous strands.

Textile fabrics having a coating, e.g. of cured resin system, to give them added body or stability have been proposed. For example certain upholstery fabrics may be back-coated with a polyurethane system on their reverse face. While it is a relatively simple matter to apply such a coating to a fabric it has hitherto not been possible to apply successfully such a coating to, for instance, an array of slivers or yarns since the problems of obtaining a coherent web while at the same time preventing the coating material striking through to the face of the fabric, and thereby spoiling the aesthetic effect, have not been overcome.

The invention seeks to provide a simple apparatus for forming a coherent web of fibrous strands such as textile yarns using a coating of resin material.

According to the present invention there is provided an apparatus which comprises a support member for an array of fibrous strands having a series of parallel grooves, means for holding the fibrous strands in the grooves, and means for supplying coating material to the fibrous strands in the grooves, the grooves being dimensional and spaced such that the coating material coats only one side of the array of fibrous strands.

The Invention also provides a method of forming a coherent web of fibrous strands which comprises feeding fibrous strands side by side into the nip of a roller and a support member having a series of parallel grooves in its surface such that the strands are aligned by the grooves, and applying coating material to the nip so that the strands are fixed in the aligned state.

The fibrous strands are preferably textile yarns but other strands, such as rovings, slubbing or slivers may be employed. Ideally the yarns are spun yarns of staple fibres but continous filament yarns may also be used. Because the end-use of the product is primarily decorative the yarns used may be coloured and/or fancy yarns. The yarns may be of any textile fibre, but pleasing appearance is obtained with woollen-spun yarns of wool or staple acrylic fibres, particularly 'berber' type yarns.

The support member may be a grooved roller, or may be any other suitable support means, such as grooved support bed. The means for holding the fibrous strands in the grooves is preferably a nip roller.

The means for supplying coating material is advantageously a container or trough with an adjustable outlet so that the quality of material may be metered on the array of strands. However if the coating material is supplied in the form of a sheet, the supply means could conveniently be a roller or rollers geared to the strand speed.

The strands may be passed through the apparatus by suitable driving means, e.g. driven nip rollers or a driven web take-up roller.

The grooves on the support member, e.g. one of the nip rollers, serve to align the yarns so that they are fixed to each other accurately straight and parallel. Ideally each groove will accommodate one strand such as a yarn. The coating material may be supplied to the strands before the nip as a liquid or the material may be supplied as or on a separate sheet fed into the nip over the strands. However it is an advantage of the invention that a separate backing sheet is not necessary and in the preferred form a liquid coating material is used alone.

The coating material used will depend upon the desired end-use of the product. If it is desired to produce a relatively stiff, self-supporting web adhesives such as polystyrene emulsions of polyvinyl chloride latices may be used. For a more pliable product acrylate or synthetic rubber latices may be used. The coating material, or adhesive, may be self-curing or may have catalysts and/or cross-linking agents added prior to use. It may be heat curing (thermo-setting) or thermoplastic. In the latter case the adhesive may be supplied as a sheet of thermoplastic material which is softened immediately before or actually in the nip. Furthermore the adhesive may be applied to or carried on a backing sheet, e.g. a paper sheet. However it is an advantage of the invention that with appropriate selection of adhesive no backing sheet is required, and the web may be produced from the strands and adhesive alone. It is a further advantage of the invention that the grooves hold the strands accurately parallel and produce a uniform web without using expensive warp aligning equipment.

As indicated above, various means may be employed for introducing adhesive into the nip. However it is preferred to apply the adhesive directly to the strands and maintain an accumulation or reservoir of adhesive just in front of the nip to ensure there is adequate adhesive available to form a coherent web.

The use of the rollers in the invention ensures that enough pressure can be applied to the back of the fibrous strands to enable a coherent web to be produced, while the compression of the strands within the grooves prevents or reduces strike-through of the coating material to the upper face of the web.

Preferably the strands are fed into the nip rollers already substantially aligned, for example by passage through a comb or reed arrangement. Further once the web leaves the nip rollers it must be supported until the adhesive has set sufficiently to hold the strands.

If a heat-curing adhesive is employed, heat may be applied to the web in this zone while it is being supported. The support may comprise, for example, an endless conveyor or a series of idler rollers.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of an apparatus according to the invention;

Figure 2 is a partial view on an enlarged scale of the nip rollers; and

Figure 3 is schematic view of another form of apparatus according to the invention.

Referring to figures 1 and 2 of the drawings, it can be seen that an array of woollen yarns 10 is fed from a creel or warp beam (not shown) through a pair of nip rollers 12 and a reed 14 to a further pair of driven nip rollers 16, 18. The rollers 12 are free running but have a braking device to tension the yarns 10. The bottom roller 16 is profiled with a series of parallel grooves 20, and the top roller 18 is plain. A trough 22 having an adjustable outlet feeds adhesive on to the yarns 10 above the roller 16. The web of yarns 24 leaving the rollers 16, 18 passes to a pair of similar rollers 26, 28, the upper being plain and the lower grooved as for roller 18. The grooves in the roller 26 are exactly aligned with the grooves 20 in roller 16, and the adhesive on the web is partly cured or allowed to cure by the agency of hot air blown on to the web in the zone 25 between the pair of rollers 16, 18 and 26, 28.

After leaving the rollers 26, 28 the web is supported on idler rollers 30 when further hot air may be directed at the adhesive coated surface to complete curing of the adhesive in the zone 31. Finally the web passes to a take-up roller (not shown) from which it may be removed for subsequent use.

As can be seen from figure 2, the yarns 10 are aligned by the grooves 20 of the bottom roller 16 while adhesive is applied. The yarns are accurately aligned by the grooves which are spaced and dimensioned so that the yarns substantially fill them and touch one another at the boundaries of adjacent grooves. The adhesive is therefore applied to one side only of the array and does not show through on the face.

We have found that direct or spreader application of adhesive is the most successful way to operate the method of the invention: application of adhesive via, e.g., a lick roller, does not provide sufficient adhesive adequately to fill the 'valleys' between adjacent yarns, and a coherent web is not produced. The outlet of the trough 22 is adjusted to maintain an accumulation or 'reservoir' of adhesive on the yarns 10 on top of the roller 16, which is then continuously spread over the whole sheet of yarns by the roller 18. The spacing or nip between the rollers 16 and 18 is adjustable to obtain the optimum clearance for any particular application. By this means, each yarn, and the valleys between the yarns, receive adequate adhesive to give an even, continuous coat.

The rollers 26, 28 are driven slightly faster than the rollers 16, 18 to maintain the yarns in the web 24 under tension and accurately aligned in the first curing zone. An adjustable stepping device is incorporated between the pairs of rollers.

If desired, a backing 32 may be inserted from a roll 34 at the nip of the rollers 26, 28 where it will laminate to the web 24. As previously stated, the web is by then already self-supporting and a backing will only be supplied where a particular end-use calls for it.

Figure 3 illustrates an embodiment of the invention in which the grooved rollers 16 and 26 are replaced by a grooved bed 38. A trough 22 supplies adhesive as before to an aligned array or sheet of yarns 10, and a roller 40 spreads the adhesive and coats the array to form a web 24. A second nip roller 42, equivalent to the roller 28 in the embodiment of figure 1 controls the web as it leaves the bed 38 on to idler rollers (not shown) through a second curing zone as before. The drive in this case is supplied by the take-up roller (not shown) which pulls the yarns 10 through the grooves in the bed. The rollers 40 and 42 are free to rotate and adjustable with respect to the bed.

The web produced by the method of the invention may be used for a wide variety of products, depending on the flexibility imparted by the choice of adhesive. These include wall-coverings, floor-coverings, lampshades, upholstery, soft shoe uppers, luggage, roller blinds, handbags, and the like. For a product in which increased strength across the width is desired, a backing sheet or fabric may be incorporated as described above.

The width of the apparatus is governed by the desired width of the web for a particular end-use. Similarly the number, spacing and depth of the grooves will depend largely on the types and properties of the yarns used. The viscosity of the adhesive or latex can be varied as required to suit conditions and yarn types employed. In a particular example, grooved rollers were employed with 9 grooves per inch each of 1/16" depth. 1's w.c. woollen yarns were passed through the apparatus (in the configuration of figure 1) and coated with latex, either a polyvinyl acetate or a styrene butadiene rubber containing an inert filler.

Claims

1. A method of forming a coherent web of fibrous strands which comprises feeding fibrous strands side by side into the nip of a roller and a support member having a series of parallel grooves in its surface such that the strands are aligned by the grooves, and applying a coating material to the nip so that the strands are fixed in the aligned state.

2. A method as claimed in claim 1 in which the fibrous strands are textile yarns.

3. A method as claimed in claim 2 in which the yarns are woollen-spun yarns of natural or synthetic fibres.

4. A method as claimed in any of claims 1 to 3 in which each groove accommodates one strand.

5. A method as claimed in any one of claims 1 to 4 in which the array of strands is directly supplied with coating material just before the nip.

6. A method as claimed in any of claims 1 to 5 in which the coating material is a settable liquid composition.

7. A method as claimed in claim 6 in which the composition is a polystyrene emulsion, a polyvinylchloride latex, an acrylate latex, a polyvinyl acetate latex or a styrene butadiene rubber latex.

8. A method as claimed in any of claims 1 to 7 in which the strands are aligned by passage through a reed before entering the nip.

9. A method as claimed in any of claims 1 to 8 in which a second nip similar to the first is spaced from the first and aligned therewith, the zone between the first and second nips being a first curing zone.

10. A method as claimed in any of claims 1 to 9 in which the nip or nips is or are formed by a plain roller and a grooved roller.

11. A method as claimed in any of claims 1 to 9 in which the nip or nips is or are formed by a plain roller and grooved support bed.

12. A method as claimed in any of claims 9 to 11 in which a backing sheet is laminated with the web at the second nip.

13. A method as claimed in any of claims 1 to 12 in which the web is supported for a time sufficient for the coating material to cure or be cured before being collected on a take-up roller.

14. A method of forming a coherent web of fibrous strands substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

15. A coherent web of fibrous strands aligned parallel and in contact held together by a coating material applied to one face only.

16. A web as claimed in claim 15 in which the fibrous strands are textile yarns.

17. A web as claimed in claim 16 in which the yarns are woollen spun wool or acrylic fibre yarns.

18. A web as claimed in any of claims 15 to 17 in which the coating material is cured polystyrene, polyvinylchloride, acrylate, polyvinylacetate of styrenebutadiene rubber.

19. A web as claimed in any of claims 15 to 18 additionally having a backing sheet laminated to the coating material.

20. A web whenever produced by a method according to any of claims 1 to 14.

21. An apparatus which comprises a support member for an array or fibrous strands having a series of parallel grooves, means for holding the fibrous strands in the grooves, and means for supplying coating material to the fibrous strands in the grooves, the grooves being dimensional and spaced such that the coating material coats only one side of the array of fibrous strands.

22. An apparatus as claimed in claim 21 in which the means for supplying coating compound comprises a container located adjacent the nip having an adjustable outlet.

23. An apparatus as claimed in either of claims 21 or 22 in which the support member is a grooved roller.

24. An apparatus as claimed in either of claims 21 or 22 in which the support member is a grooved support bed.

25. An apparatus as claimed in any of claims 21 to 24 in which the means for holding the fibrous strands in the grooves is a nip roller.

26. An apparatus as claimed in any of claims 21 to 25 in which a second support member is provided spaced from the first and aligned therewith, the zone between the first and second support members being provided with means to aid curing of the coating material.

27. An apparatus as claimed in claim 26 having a roll for providing a backing sheet to be fed with the array of strands on to the second support member.

28. An apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

New Claims or Amendments to Claims filed on 27 May 1980.
Superseded Claim 1.

New or Amended Claims:—

1. A method of forming a coherent web of fibrous strands which comprises feeding fibrous strands side by side into the nip of a roller and a support member having a series of parallel grooves in its surface such that the strands are aligned by the grooves, and applying a coating material to one side only of the array of strands so that the strands are fixed in the aligned state.

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SUBSTITUTE

REMPLACEMENT

SECTION is not Present

Cette Section est Absente

ABSTRACT OF THE DISCLOSURE

A flexible weftless tape for strapping consisting of a single ply of juxtaposed threads of synthetic resin, more particularly polyester yarn of tire cord grade, the threads adhered by an adhesive product especially selected for the yarn and containing a copolymer of acrylic and butyrate monomers produced by polymerizing the monomers under elevated temperature and at high pressure.

This invention relates to tapes or straps formed of individual strands or yarns bonded together in parallel relationship in a single layer.

In the prior art, there are various types of tapes or straps made of individual strands of material, which find use as a strapping in the packaging industry, as a substitute for metal bands. Such tapes have many advantages over metal strapping but to compete they must exhibit the following combination of properties:

(a) sufficient flexibility so that they can be bent around a corner readily;

(b) sufficient stiffness to enable them to be fed under a pallet or through a slot in an automatic packaging machine;

(c) a unity of structure so that the individual cords do not separate in handling, packaging and shipment;

(d) light weight and high strength; and

(e) a sufficient roughness or friction of surface to prevent slippage within a seal.

The prior art teaches the production of such tapes by joining together individual strands or yarns through adhesives such as polyvinyl alcohol, etc. The products thus produced have been shown to possess very good properties. However, with the present invention, applicant has developed an improved tape having greater strength characteristics, and which also have greater resistance to abrasion, by employing a plurality of individual yarns bonded together, in a side-by-side relationship, using an adhesive formed by co-polymerizing two or more of the monomers selected from acrylonitrile, butadiene, butyl acrylate, butyl methacrylate, dibutyl maleate, di (2-ethylhexyl) maleate, dioctyl maleate, divinylbenzene, ethyl acrylate, ethylene, 2-ethylhexyl acrylate, ethyl methacrylate, isobutyl acrylate, methacrylic acid, methyl acrylate, methyl methacrylate, methyl styrene, propyl acrylate, propylene, styrene, vinyl acetate, vinyl butyrate, vinyl chloride and vinylidene chloride.

The tape or strap products of the present invention, as

previously mentioned, are made from individual strands or yarns which are adhesively secured together. The strands or yarns which may be employed are preferably of the polyester type. However, other individual strands or yarns, such as those made from "nylon", polyethylene, polypropylene and similar synthetic resin fibre yarns, may be employed.

It is preferred that all of the individual yarns making up the tape be of substantially the same denier, so as to form a tape having a substantially uniform thickness. However, variations in the thickness of the yarns may also be employed should a product of that nature be desired.

The polyester or similar yarns used in the manufacture of the products, may have a denier ranging from about 200 to 60,000, and may be either single or plied yarns having twist factors from 0 upwards, e.g. $2\frac{1}{2}$ - 9, and from 9 - 14 twists per inch. Particularly preferred as material for forming the tape of the present invention is polyester yarn, which may be of different grades, e.g. tire cord grade.

The products of the present invention may be produced using the process and apparatus described in Canadian Patent 544,703. Briefly summarized, the method of that patent includes the steps of feeding from a supply source a plurality of continuous threads of fibrous material, aligning said threads in side-by-side parallel relationship and passing them through a bath of a water solution of a synthetic resin which is flexible when dry, while in the bath continuously and progressively bringing said threads together weftwise to parallel touching relationship by sliding lateral pressure and under constant longitudinal tension, then while maintaining the thus formed single ply tape under said longitudinal tension, subjecting it to additional rolling transaxial pressure to compact said tape to substantially uniform width and to expel excess adhesive, and drying said tape while constantly maintaining said longitudinal tension.

The apparatus disclosed in that patent includes means for feeding the plurality of individual threads, means for passing the individual threads over an adhesive bath to coat the thread with an

adhesive, means for progressively bringing the individual threads together into a parallel relationship with the threads lying side-by-side, means for subjecting the tape to transverse pressure and means for creating longitudinal or axial tension on the threads. In the apparatus shown in the patent, the aligned threads are rotated over a pair of spaced-apart drums, the drums being adjustable to permit the desired tension to be placed on the tape, as described in greater detail hereinafter.

Depending on a particular type of yarn material being employed, and the adhesive which is used, as selected from the above group, the process and apparatus described in Canadian Patent 544,703 may be modified to include a source of heat in order to expedite the setting and curing of the adhesive.

The particular type of heater apparatus used is not critical and either electrical or gas heaters, for example, may be employed. The degree of heat required depends on the particular adhesive and, in general, will be enough to set and cure the adhesive in a desired period of time.

The application of heat to the tape, when using for example polyester yarn with a compatible adhesive, also has the advantage of causing the polyester yarn to shrink, thus "heat setting" the product.

The adhesive used may be in various forms, although aqueous and non-aqueous emulsions and dispersions of the above monomers, co-polymerized, and with or without post addition of monomeric or polymeric plasticizers, may be used. The method of application of the adhesive composition may be by either aqueous or solvent phase deposition of the co-polymer to the yarns.

The amount of adhesive employed to coat the individual strands or yarns of the material forming the tape is not critical and will depend on the actual material being used. An amount, calculated on the basis of a dry weight pick-up, of between 15% and 50%, has been found to be satisfactory, desirably 33% to 40%.

In the products of the present invention, the number of individual strands employed in any given product will vary according to different factors, for example with the denier of the individual yarns,

the width of the product desired, strength characteristics, etc. Typical products of the present invention include tape, twine or strapping, having a width ranging up to 3 inches or more, with the denier of the individual yarns being within the previously-mentioned range. In this case the twine products may be made having as few as two yarns or strands adhesively secured together.

It will be understood that in describing the various monomers which may be used to form the co-polymeric adhesive, that the terms employed are meant to denote such compounds containing a sufficient amount of curing agent. The choice of the curing agent is within the skill of those skilled in the art.

The present invention is also illustrated in conjunction with the attached drawings, in which:

Figure 1 is a diagrammatic view of a section of tape formed by the present invention;

Figure 2 is a cross-sectional view of the tape portion shown in Figure 1;

Figure 3 is a diagrammatic elevational view mainly in section of an apparatus by means of which the method may be carried out;

Figure 4 is a plan view of the apparatus shown in Figure 3;

Figure 5 is an enlarged detail view along the line 5-5 of Figure 3, showing a strand guide plate;

Figure 6 is an enlarged detail view along the line 6-6 of Figure 3 showing the series of pressure rollers;

Figure 7 is an enlarged detail view located along the line 7-7 of Figure 3 showing a further strand guide plate; and

Figure 8 is an enlarged detail view along the line 8-8 of Figure 3 showing the initial strand guide plate.

In the drawing, reference numeral 10 denotes a supply creel mounting bobbins 12 which supply individual yarns of, for example, polyester material. Strands "A" are led to an adhesive containing tank, containing one of the above-mentioned adhesives. The ends are aligned in spaced-apart parallel relationship by a comb 16, where after they pass around a first guide plate 18 in the tank 14, mounted on a supporting frame

20. The recess brings the strands together.

Thereafter, the strands are passed over a second guide plate 24 having arcuate concave guiding recesses 26, whereby the individual strands of yarns are compacted. The product is then passed between pressure rollers 28, 30, and 32, which are freely mounted and which act to further compact the partially finished product and expel the excess adhesive. The product is then fed over a third guide plate 36 with arcuate guiding recesses 38 and thereafter on to a main drying drum 40. A tension member 60 is mounted between the drum 40 and the guide 36.

The tape product is fed and maintained in spaced-apart alignment on the rotating drum 40, driven by suitable means, as for example, a further drum 100. The drum 100 also provides a means for placing a drive tension on to the products as they rotate.

Mounted adjacent the drum 40 on one side thereof are a plurality of heating units designated by reference numeral 102. Each unit may be either gas or electrically heated whereby the heat is downwardly directed on to the tape product as it passes over the drum 40. The heating units 102, as shown in the drawing, are each capable of delivering the required amount of heat; in the case of the polyester material, the heating units 102 will deliver approximately 12,000 BTU (3,000 kilogram-calories) each. The amount of heat can be regulated by suitable means (not shown) depending on the product used.

After passing over the drum 40 a predetermined number of revolutions, the tape product is then passed between and over driven finishing rolls 50, 52, and 54. The finished product is then wound on to a suitable storage roll 50 mounted on a supporting frame. The product of the present invention is illustrated in Figures 1 and 2. As will be seen, it includes a plurality of individual yarns 106, aligned in a side-by-side relationship and adhesively secured together by means of the particular adhesive previously described.

EXAMPLE 1

This example demonstrates the manufacture of polyester tapes suitable for strapping purposes.

The apparatus and process disclosed in applicant's earlier

Canadian Patent 544,7[illegible] was employed, with the modification that the main drum over which the wet adhesive-coated polyester tape was passed, was provided with heating elements spaced from the drum and providing an equivalent of about 12,000 BTU (3,000 kilogram-calories) heat. The heating units spaced from the drum were arranged to cover approximately 1/2 of the drum surface in a direction transaxial to the direction of movement of the tape.

Thirty-two individual strands of medium twist polyester yarn of tire cord grade were fed separately into a bath of adhesive, where the strands were individually coated. The bath consisted of an adhesive designated in the trade as "Co-polymer 239 V 30" produced by the Stein Hall Company, which was a mixture of polyvinyl acetate co-polymers believed to be composed of acrylic and butyrate monomers produced by polymerizing the monomers under elevated temperatures and extreme pressure. The adhesives had a solids content of between about 53 to 56%, a viscosity of about 3,000 (plus or minus 300 CPS) - Brookfield 3/20 RPM/24°C a pH of about 4.5 (plus or minus 1.0) and a weight of approximately 10.8 lbs. per gallon (1.08 gram per cubic centimeter). This adhesive has good water resistance.

The individual strands of the polyester yarn were then drawn together over a guiding element so as to form a single flat layer of the individual yarns. The resulting tape was then passed over the drum and its auxiliary drum, a plurality of times, and heated to a temperature sufficient to cure the adhesive and set the product. The rotation of the drum and the degree of heating the tape product was governed to cause the desired curing and setting of the adhesive by the time the tape was taken-off the drum. While being rotated, the tape was rotated under longitudinal axial tension, and with the specific yarn employed, and the type of adhesive, the shrinkage of the tape occurred, which provided a pre-shrunk product.

The rotating tape product was then compared to known tape products having similar yarns but with known prior art adhesives, and it was found that the product of the present invention possessed superior

strength properties.

EXAMPLE II

The procedures of Example 1 were repeated using this time medium twist polyester yarn with a similar adhesive of Example 1. The specific adhesive used was that marketed under the trade mark "TS-280" produced by Stein Hall Company. This adhesive has slightly different plasticity properties than the adhesive used in Example 1, and low temperature properties. After formation of the tape according to the procedures of Example 1, a product was produced which consisted of identical yarns joined together in a side-by-side relationship, the tape having a width of about 1.50 inches (3.81 cm), the indicated yarns a diameter of approximately .15 inches (.381 cm).

The strip of the tape thus formed was made into a sling, i.e. a portion of the product was cut, which had a length of approximately 5 feet (1.5 meter). This strip was tested to determine its load-bearing characteristics. It was found upon testing that the strip was capable of bearing a load of more than 6,000 kilos--far more than would have been expected when employing a similar tape made of the same yarns but using prior art adhesives.

The sling produced in the above Example II illustrates a further embodiment which has wide application for use as cargo slings. Cargo slings find wide application in the shipping trade, particularly now since the more modern practices involve the use of containers which in turn involve units and palletizing where slings find wide application.

It is not unusual, to save a great deal of time and labour, that the slings accompany the loads to their destination so that they will be in position for unloading. The trouble and cost to get such slings returned to the original shipper are obvious. Therefore, it is very important to produce slings as inexpensively as possible so that they can be regarded as a one-way item without undue cost to the shipper.

The product of Example II meets the above requirements. In greater detail, the yarn used in Example II has a tenacity of the order of 7 1/2 to 8 grams per denier; it will make a strap produced from ten ends in the above example of approximately 10,000 lbs. (4540 kilograms).

In the production of large denier products such as in Example II, a greater amount of heat is normally required to cure the adhesive than is the case when producing strapping from typical yarns of up to 3000 or 6000 denier, for example. This can be achieved in two ways:

(a) by increasing the number of heaters to 8 of approximately 12,000 B.T.U'S (3,000 kilogram-calories) each;

(b) By slowing down the speed of the strapping passing in front of the heaters from the 35-50 yds. per minute normally achieved when making a strap of 3/4" width from 1300 denier 2-ply material, to approximately 5 yards per minute when using the 60,000 denier material.

The apparatus illustrated in the drawings may also be modified by changing the shape of the ribs on the drum 100 as follows; interposed between the existing L-shaped ribs additional and higher ribs were introduced along the first part of the roller extending approximately one-half its length.

The products of the present invention may be formed into slings by any conventional means such as, for example, by looping the ends of a suitable length, the free ends being joined to the body of the strap in various methods which include stitching, binding, clamping with a sleeve or, by an adhesive, with our without some mechanical assistance.

If desired, the strapping so produced can also be protected from wear and tear and from other external effects by extruding a sheet of plastic around the strap in a manner similar to that used in coating a conventional clothesline.

While it is mentioned that the process and materials afford a strapping which can be made into an inexpensive sling which could be used on the basis of one-way utilization, it may of course be used several times and, in fact, could find applications in industry and materials handling generally as well as specifically for cargo.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CL[illegible]ED, ARE D[illegible]NED AS FOLLOWS:-

1- A flexible weftless tape comprising a single ply of juxtaposed touching parallel threads of polyester yarn and an adhesive bonding said threads together, said adhesive being the cured product of an adhesive bath of a mixture of polyvinyl acetate co-polymers having a solids content of between 53 and 56%.

2- A weftless tape as claimed in claim 1, wherein the adhesive bath has a viscosity of about 3,000 CPS and a pH of about 4.5.

3- A weftless tape as claimed in claim 1 or 2, wherein the threads consist of medium twist polyester yarn of tire cord grade.

4- A flexible weftless tape comprising a single ply of juxtaposed touching parallel threads of twisted polyester yarn of tire cord grade and an adhesive bonding each thread to an adjacent one, said adhesive containing a mixture of polyvinyl acetate co-polymers and having, when not cured, a solids content of between about 53 and 56%.

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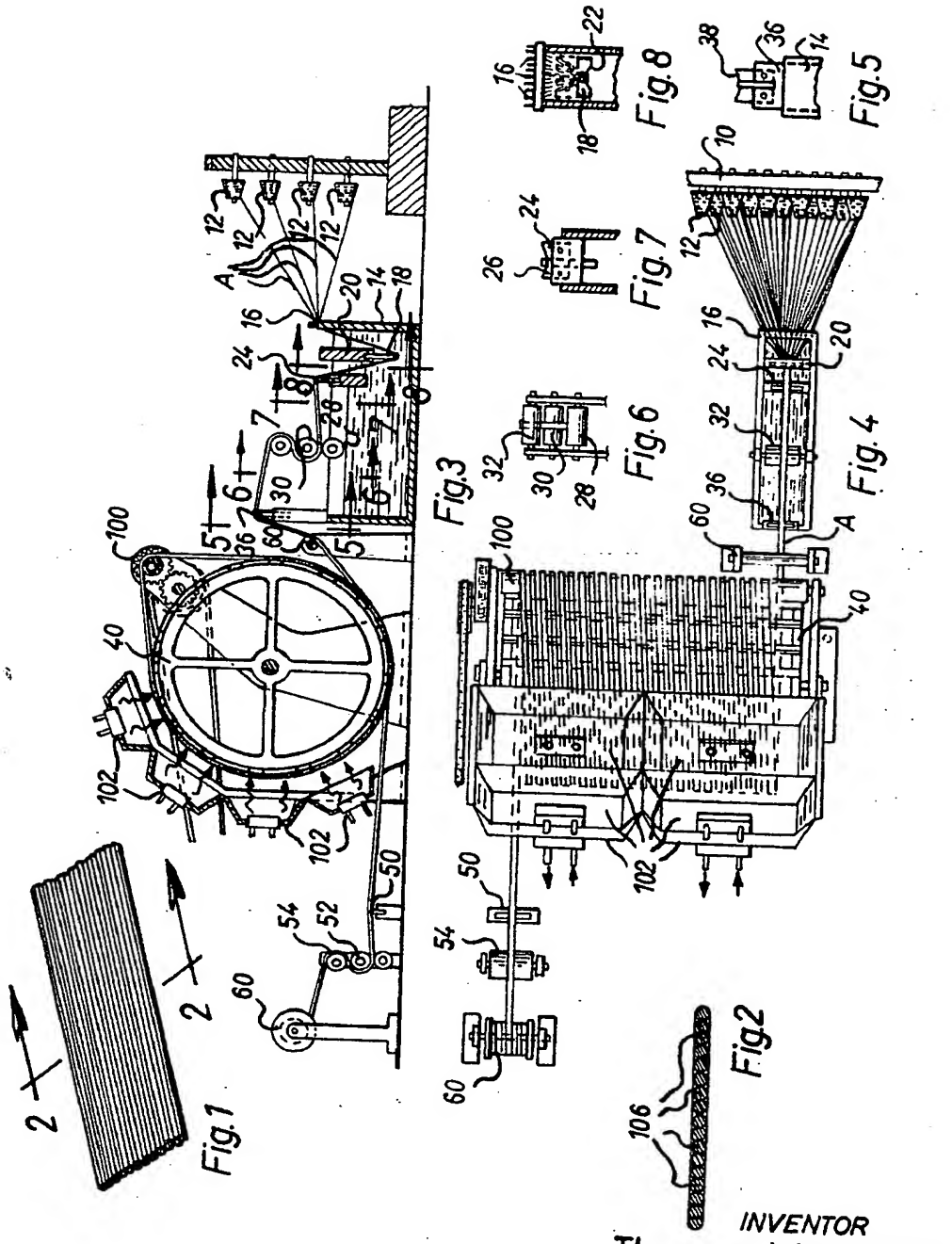

Fig.1

Fig.2

Fig.3

Fig.4

Fig.5

Fig.6

Fig.7

Fig.8

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